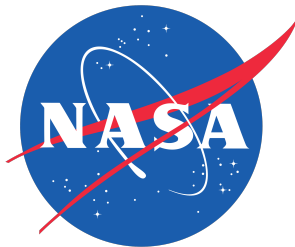




DGEN Aeropropulsion Research Turbofan (DART) Test Plans

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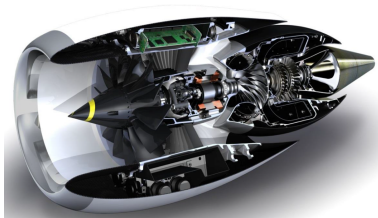
Acoustics Technical Working Group
Cleveland, OH, October 16–17, 2018

NASA Advanced Air Vehicles Program
Advanced Air Transport Technology Project
Aircraft Noise Reduction Subproject

Introduction



- DGEN380 Aeropropulsion Research Turbofan (DART)
 - Two-spool high-bypass ratio ($BPR=6.8$) geared (3.32 ratio) turbofan
 - Single stage centrifugal compressor and axial high-pressure turbine (52,000 rpm)
 - Wide-chord fan coupled to axial low-pressure turbine (43,000 rpm)
 - Reverse flow annular combustor
 - FADEC controls engine to ambient-temperature-corrected LP shaft speed with excellent repeatability



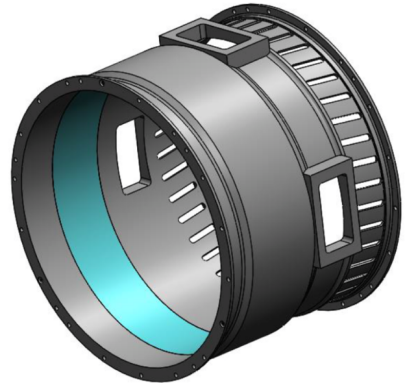
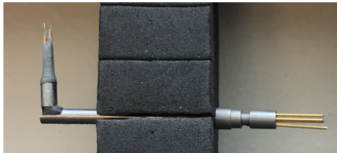
DART 2019 Test Entry Research Objectives



- DART test planned for March-April 2019
- Research objectives:
 - Obtain initial set of rotor wake data on DART to compare with CFD
 - Exploratory noise survey of DART
 - Core nozzle circumferential pressure field mapping using infinite-tube probes (ITP)
 - Instrumentation group performing TRL advancement within an engine environment
- Modifications will be made to the following DART components:
 - New fan case with instrument ports for HW and HF measurements
 - Core nozzle centerbody modified with integral ITP ports

Fan Intra-Stage Velocity Measurement Experiment

- Hotwire (low rpm) and hotfilm (low, moderate, and high rpm) radial surveys conducted at 2 axial locations between rotor and stator to measure blade wake evolution.
- Compare results obtained with straight and L-shaped probes.
- Instrumentation ports plugged during other testing to ensure smooth fan duct, avoiding extraneous noise sources
- POC: Gary Podboy

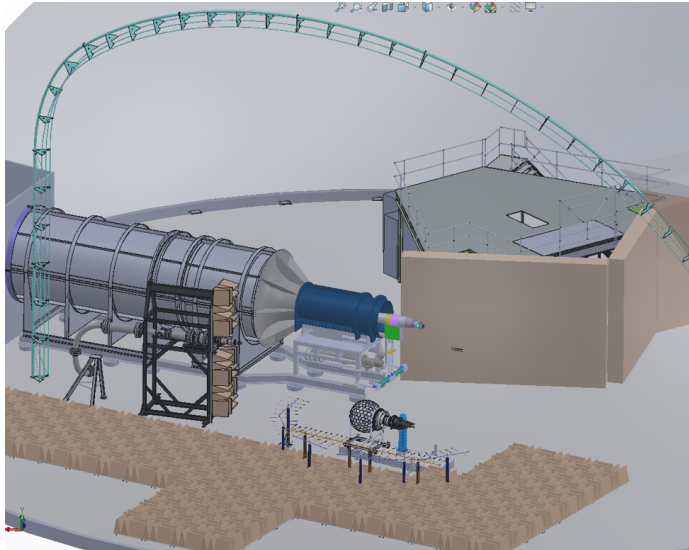




Exploratory DART Noise Survey

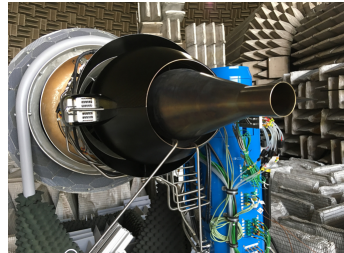
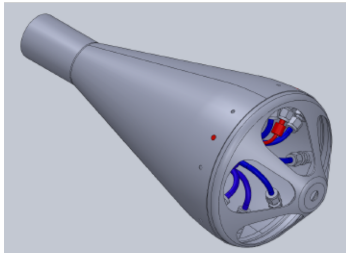
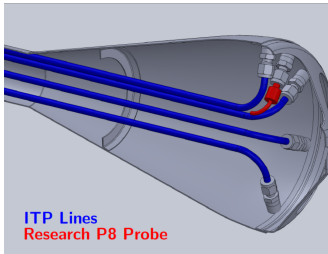
- Several objectives to understand DART's noise sources:
 - Preserving directivity of measurements propagated to geometric far-field
 - 2017 data suggest DART is aft-dominant, so studies of inlet noise may benefit from a barrier wall (whose size and placement will be determined)
 - Determine the azimuthal variation of DART's sound field
- These objectives may be addressed using:
 - AAPL 24-microphone overhead array
 - Sideline array of 30-70 mics at varying radial distances from DART
 - Aft barrier wall to be used in conjunction with sideline array
 - Translating phased array to better determine source location as a function of observer angle
 - Spherical microphone array around engine
- POC: Cliff Brown

Overview of DART in AAPL



Core/Combustor Noise Research

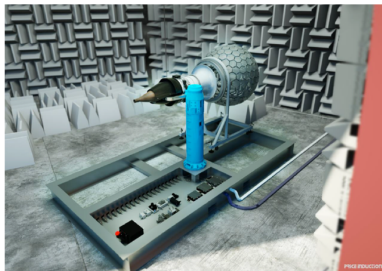
- Adding circumferential array of 8 unsteady pressure measurements in an infinite-tube probe configuration at core nozzle to improve understanding of DART combustor noise
- Measurements on engine made simultaneously with mid- and far-field microphone locations at aft polar angles from ~ 110 - 140° at 10 ft and about 38 ft, respectively



Summary



- DART 2019 test will build on knowledge gained through previous testing
- Increasingly invasive testing involving modified engine components
- Test planning and requirements development underway



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Questions?

